R E M A R K S

Applicants appreciate the Examiner's thorough consideration provided in the present application. The amendments to the specification correct minor typographical errors. No new matter is believed to be added to the application by this Amendment.

Status of the Claims

Claims 1 and 5-8 and 10-20 are pending in the application. Claims 2, 3 and 4 have been canceled by this Amendment. Claims 10-20 are newly presented for the Examiner's consideration.

Support for the amendments to claim 1 can be found in the specification at page 4, line 25 to page 5, line 10, at page 9, line 16 to page 10, line 10, and in Experimental Examples 1-3. Support for newly added claims 10-18 can be found at page 11 of the specification. Support for newly added claims 19 and 20 can be found at pages 11 and 13 of the specification.

Rejection Under 35 U.S.C. §103(a) Over Shinozuka '305 in View of JP '789

Claims 1-8 are rejected under 35 U.S.C. §103(a) as being obvious over Shinozuka '305 (U.S. Patent 5,298,305) in view of JP '789 (JP 09098789). Applicants traverse this rejection and respectfully request reconsideration and withdrawal thereof.

The Present Invention and its Advantages

The present invention is directed at addressing problems that arise when a sulfide, e.g., ZnS, having lower heat conductivity than nitride is provided on a recording film to prevent a decrease in the recording sensitivity. Unfortunately, when repetitive rewriting is performed when using a sulfide-containing protective film, sulfur diffuses into the recording film so that optical constants and the recrystallization rate degrade from their initial state. The result is an increase in jitter and a deterioration in rewriting durability.

In the invention, this problem is addressed by utilizing an element that retards the diffusion of sulfur or does not deteriorate the optical constants or crystallization rate, even if diffusion occurs. These elements can be one of Si, P, V, Mn, Fe, Co, Ni, Cu, Zn, Nb, Mo, Ru, Rh, Pd, Ag, Cd, Sn, Ta, Os, Ir, Pt, Au, Tl, Pb, Bi or Cr. When used in an amount of from 0.1-10%, a barrier layer is formed to prevent deterioration of rewriting durability.

The invention provides excellent results. In the conventional art, after extended storage in a severe environment, an amorphous mark changes its properties due to oxidation of the amorphous mark, and aggregation of impurities present in the recording film fails to be erased by overwriting. That is, overwriting failure results. To prevent overwriting failure, the nitrogen content, i.e., gradient, of the interface between the recording film and the protective film was evaluated. It was unexpectedly found that this problem is solved by

having the nitrogen content of the protective film side being greater than that of the recording film side, and changing the amount of the nitrogen content in the direction of thickness of the film with the interface between the films as a boundary is 1-50%.

Further, when the nitrogen content in the protective film is not more than 25%, heat conductivity and optical properties such as refractivity can be optimized so that recording sensitivity, rewriting durability and archival overwrite properties are improved.

Distinctions of the Invention over Shinozuka '305 and JP '789

Shinozuka '305 pertains to a phase change-type information recording medium that has a substrate 1, a protective layer 2, a recording layer 3 and a protective layer 4, consecutively. See Fig. 1 of Shinozuka '305. The abstract of Shinozuka '305 discusses a recording layer of a material of the general formula:

$$Ag_{\alpha}In_{\beta}Te_{\gamma}Sb_{\delta} + Mx$$

where $\alpha + \beta + \gamma + \delta + x = 100$ and M can be B, N, C, P or Si. The protective layers of Shinozuka '305 contain a nitride such as SiN, SiZrN or AlN.

Shinozuka '305 fails to disclose or suggest that the nitrogen content changes in the thickness direction with the interface between the recording layer and the protective layers. Shinozuka '305 additionally fails to disclose or suggest a sulfide contained in the protective layer to prevent a decrease in the recording sensitivity,

and the diffusion of sulfur from the protective layer into the recording layer is retarded by adding the specific elements enumerated in instant claim 1 of the invention. Shinozuka '305 further fails to disclose or suggest adjusting the nitrogen content in the protective layer to optimize heat conductivity and optical properties.

Realizing the failure of Shinozuka '305 to suggest a claimed embodiment, the Examiner turns to the teachings of JP '789.

JP '789 pertains to an optical information recording medium having a substrate 1, and under layer 3, a protective layer 4, a recording layer 5 and an upper layer 6. JP '789 discloses the protective layer containing Ge-N, and the upper layer containing ZnS-SiO_2.

JP '789 fails to disclose the protective layer containing a sulfide such as ZnS. JP '789 additionally fails to teach that the upper layer contains nitride and fails to address the decrease in sensitivity that nitride causes. JP '789 further fails to address the problem of sulfur diffusion into the recording layer, and fails to present any way to prevent this diffusion, such as, e.g., the addition of the elements enumerated in instant claim 1. Yet further, JP '789 fails to disclose or suggest that the nitrogen content in the protective layer is adjusted to a specific range to optimize thermal conductivity and optical properties.

Further, both Shinozuka '305 and JP '789 have a recording layer that is sandwiched directly in contact with the protective layers. In

contrast, the present invention has a recording film that is in contact with only one of the protective films, and the bottom protective film is shielded from the recording film by an interface film.

As a result, a person having ordinary skill in the art would not be motivated to combine the teachings of JP '789 with those of Shinozuka '305 to produce a claimed embodiment of the present invention. Accordingly, the *prima facie* case of obviousness has not been made for at least the above reasons alone.

Also, Shinozuka '305 at column 4, lines 47-59 discusses the preferred utilization of nitride alloys such as SiN, SiZrN and AlN for the protective layers. In contrast, the specification at pages 8 and 9 discusses the disadvantages of the nitride protective films. To overcome these disadvantages, the present invention uses sulfide (ZnS-SiO_2), combined with steps such as doping the recording film and using an interface film to retard sulfide diffusion into the first protective film. As a result, the principle of operation of Shinozuka '305 is being changed. If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. In re Ratti, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

Accordingly, the *prima facie* case of obviousness has not been made for at least this additional reason alone.

Further, even if it assumed *arguendo* that the teachings of Shinozuka '305 and JP '789, the present invention shows unexpected results over the prior art references. These unexpected results are set forth at, e.g., pages 17-19 of the specification, where disks made according to the invention showed a jitter of less than 8.5% after 500 hours at 80°C and 90% RH, but a comparative disk had a jitter of greater than 15%. As a result, any case of obviousness is rebutted by these unexpected results.

Accordingly, Applicants believe all of the instant claims of the invention are patentable over Shinozuka '305 and JP '789, and withdrawal of the rejection is respectfully requested.

Information Disclosure Statements

Applicants thank the Examiner for considering the Information Disclosure Statements filed July 27, 2000, and November 16, 2000, and making the initialed PTO-1449 forms of record in the application in the Office Action mailed November 16, 2001 (Paper No. 5).

Conclusion

All the stated grounds of rejection have been properly traversed and/or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently pending rejections and that they be withdrawn.

It is believed that a full and complete response has been made to the Office Action, and that as such, the Examiner is respectfully requested to send the application to Issue.

In the event there are any matters remaining in this application, the Examiner is invited to contact Robert E. Goozner, Ph.D., Registration No. 42,593 at (703) 205-8000 in the Washington, D.C. area.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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By _____

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Attachment: Version with Markings to Show Changes Made

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

The paragraph beginning on page 6, line 6 has been amended as follows:

On the other hand, in case the changing amount of the nitrogen content is increased with the interface between the films as a boundary, the change of the nitrogen content becomes more discontinuous, and, hence, formation of the crystal nuclei is further accelerated. In this case, failure in overwriting after [left in] exposure to a severe environment is not seen, but since the crystal nuclei are formed in excess, there is caused a problem that the once recorded information erases after [left in] exposure to a severe environment. Therefore, the gradient of the nitrogen content with the interface between the films as boundary must be smaller than a certain value.

IN THE CLAIMS:

Claims 2, 3 and 4 have been canceled.

The claims have been amended as follows:

1. (Twice Amended) An information recording medium comprising a substrate on which at least a recording film which undergoes change in atomic arrangement upon irradiation with recording

beams and a protective film comprising a dielectric are formed, said recording film and said protective film being formed in contact with each other, wherein the protective film contains a sulfide and the nitrogen content in the protective film is not more than 25 at.%, the recording film contains Ge-Sb-Te based material and 0.1-10 at.% of at least one element selected from the group consisting of Si, P, V, Mn, Fe, Co, Ni, Cu, Zn, Nb, Mo, Ru, Rh, Pd, Ag, Cd, Sn, Ta, Os, Ir, Pt, Au, Tl, Pb, Bi and Cr, the element bonds to sulfur to produce sulfide or produces a barrier layer inhibiting diffusion of sulfur, nitrogen contents on both sides of interface at which the recording film and the protective film contact with each other is such that the nitrogen content of the protective film side is greater than that of the recording film side and the changing amount of the nitrogen content in the direction of thickness of the film with the interface between the films as a boundary is 1-50 at.%/nm.

Claims 10-20 are new.